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HORSE FLIES (TABANIDAE)

W. E. DOVE
U. S. Industrial Chemicals, Inc.

More than twenty species of horse flies and deer flies occur commonly in the United States and are generally recognized as serious pests of livestock. The more deadly females puncture the skin of dairy cows and other animals and drink blood. They must have blood in order to lay eggs, and they are determined in their efforts to produce another generation of horse flies so that they may repeat the performance next year. Up to the present time there has been very little opportunity for the stockman to protect the animals from these flies (Fig. 1).

Fig. 1. The western greenhead horse fly, *Tabanus phaenops* O. S.

THESE FLIES CAUSE LOSSES

The food bill for horse flies comes high. During the season for these pests the annoyance that results from their feeding on dairy cows together with the quantities of blood that are consumed are often responsible for an abrupt loss in the normal output of milk. Livestock in general are weakened and are more susceptible to diseases and other parasites. The same flies that are responsible for these losses are also capable of tranmitting certain blood-borne diseases from one animal to another.

Small numbers of horse flies can cause uneasiness, nervousness, and a bunching together of the animals for protection.

At such times the animals fail to graze and gradually lose in weight as well as in the production of milk.

A few horse flies can draw a lot of blood. If one watches the engorgement of these flies, it will be observed that the blood appears to be pumped into the abdomen of the insects until this portion of the body is greatly distended. When the blood-drinking is complete, the fly slowly leaves like a loaded bombing plane, but instead of dropping its load, it searches for a resting place in a tree, where it digests its heavy meal. The skin of the animal shows a trickle of blood, which marks the general location of the puncture by the fly, and a lot of blood may flow from this injury before it can stop bleeding. In Minnesota Phillips (1931) estimated that during a normal season dairy cattle lost an average of about one-third of a quart of blood each day to the visiting horse flies.

In areas where screwworms occur, the screwworm fly may lay its eggs on the blood-stained injury that is left by the horse fly, and soon little screwworms develop right in the living flesh.

Cattle that are greatly annoyed by horse flies will kick or hook one another, or cause a stampede. They may even be injured by running into a wire, a projecting fence, a building, or a tree. If possible, they enter dark barns for protection or hide in the low brushland. They often wade into a lake or pond until much of the body is submerged in the water. Sometimes cattle enter swamps, mire in the mud, and are found dead in a standing position.

Horse flies have long been associated with outbreaks of anthrax, and they are generally regarded as mechanical transmitters of this disease among livestock. When a fly is interrupted during its feeding upon a sick animal, it may complete its meal of blood upon a well animal. In this way it mechanically carries the organism of anthrax or other blood diseases to well animals. The occurrence of sporadic cases of anthrax some distance in advance of an outbreak certainly suggests that the disease is spread for long distances by horse flies.

Of great concern to the owner of cattle is the ability of horse flies to transmit anaplasmosis among the animals. Every year when horse flies occur, the dairyman and the breeder of beef cattle want to do something about it. They ask where the flies develop and what can be done to keep these flies from biting the animals.

NO PRACTICAL CONTROL FOR BREEDING PLACES

The stockmen cannot control the breeding places of horse flies because there are no specific procedures that are practicable for preventing development of this pest. They are found most abundantly along water courses and in localities where water remains upon the land more or less permanently. They develop from larvae that remain in the mud and wet soil for several months, sometimes almost a year. An important species reported by Dr. H. H. Schwardt (1949) in New York does not require any free water for its development but emerges from the sod of pasture land. This means that the breeding place for this species is even more extensive and far more difficult to control than those previously known for other species of these flies.

Where horse flies emerge in abnormally large numbers, they have been known to celebrate the occasion with a dance. In the Everglades of Florida, where the dance was observed between early dawn and sunrise, (Moser and Snyder, 1918), there was a distinct humming sound, and thousands of the flies danced in mid-air near the top of the trees. Some of the flies were brought down by gunfire and were examined. They were found to be males of a single species, so the procedure is regarded as a mating one.

One to two weeks after the flies emerge from their breeding places, they gorge themselves with blood and lay eggs. These are deposited in masses which resemble somewhat the dropping of a bird. On close examination one will observe that they contain overlapping rows of eggs, which resemble shingles on the roof of a house. They are found cemented to rocks that are partly submerged in running water of creeks, or in still water on edges of ponds or lakes, where they are attached to overhanging blades of grasses or to other vegetation. After an incubation period of a couple of weeks some hatching occurs, and the newly emerged larvae continue to appear on the egg mass for a period of about a month or longer. The young larvae enter the wet soil, where they feed upon decaying animal matter such as dead earthworms. As they grow and their skins get too small for them, they molt and pass into the next instar. This occurs about four different times during development of the larvae. They usually become fully developed in about nine or ten months, after which time they become quiet and enter the pupa, or resting, stage. Some larvae of the greenhead

species, *Tabanus lineola*, Fab., have been reared under laboratory conditions in Oklahoma in twenty-nine to ninety-two days. In nature, also, it has been observed that two generations of this species occur in a single season.

When horse fly larvae complete their growth, they become shorter and quiescent, and the outer skin hardens to form a protective covering for the pupa stage of the insect. Within a couple of weeks the pointed end splits open, and the fly emerges and rests for an hour or so until it becomes dry.

NATURAL ENEMIES NOT SUFFICIENT

Some horse flies are killed by predacious wasps, and many are caught by dragon flies, but these two kinds of natural enemies play only a very small part in the control of these pests. The most successful method for natural control is probably the natural use of a small wasp, *Phanurus emersoni*, Gir., that lays its eggs in the eggs of the horse fly. These parasitic wasps actually kill about 90 per cent of the young horse fly larvae before they are able to hatch. This tiny parasite walks from egg to egg on the mass of horse fly eggs and carefully places its own eggs in the individual eggs of the horse fly. Instead of a horse fly larva, a little wasp parasite develops and emerges. A single female of this parasite can prevent development of more than one hundred horse flies. The main difficulty is that the benefactor does not fly for long distances. Almost twenty-five years ago the writer, working with D. C. Parman at Uvalde, Texas, found that this parasite occurred at certain crossings of two creeks in southwest Texas, and that it was present year after year in the same locations (Parman, 1928). Carefully made examinations at nearby crossings of the same creeks failed to reveal the presence of any of these parasites. In order to get distribution of this valuable insect, collections of egg masses that contained the parasites were made and distributed near the crossings of two of the creeks in the canyons of southwest Texas where no parasites could be found. The egg masses were placed in screened jars so that emerging parasites could become established in a natural manner. Because plenty of horse fly eggs were available, they readily established themselves. Along these two creeks in two of the canyons of Uvalde County, the little wasps have continued to parasitize most of the eggs of *Tabanus phaenops*. During the past twenty-four years there have been no outbreaks of horse flies in the two canyons where these para-

sites were distributed. Prior to the distribution of the parasites, stock men say that outbreaks were of annual occurrence and were much dreaded by all owners of livestock.

ANIMALS CAN BE PROTECTED

Before combinations of piperonyl butoxide and pyrethrins were made commercially available, there was no spray that would protect animals from horse flies. At the present time such sprays are the only ones that will protect animals against horse flies. During the past four years suitable combinations of these two ingredients were devloped for emulsions, wettable powders, and oil solutions, which make it possible for the owner of livestock to adequately protect animals against horse flies as well as all other species of biting flies and gnats. The development and introduction of them has been a gradual process in certain areas where tests could be made on animals in pastures.

Fig. 2. Pastured cattle being sprayed with Pyrenone for protection from horse flies. This spray is highly effective also against other biting flies.

As early as 1946 a preliminary report was made at the meetings of the American Society of Tropical Medicine at Miami, Florida. In substance it reported that piperonyl butoxide and pyrethrins, now known commercially in combination as Pyrenone, had been used to protect animals from Tabanids (horse flies) from two days to two weeks, the degree of protection depending upon the concentration used (Dove, 1947). The tests that gave two days' protection of dairy cows were conducted at Baltimore with dilute sprays, and other tests lasting for at least two weeks were made in Kansas with an undiluted emulsion concentrate (Fig. 2).

TABLE 1.—PROTECTION OF CATTLE FROM HORSE FLIES WITH AN EMULSIFIABLE CONCENTRATE CONTAINING 10 PER CENT PIPERONYL BUTOXIDE AND 1 PER CENT PYRETHRINS.

Tests Made In:	Number of Animals	Diluted with Water	Pints per Animal	Days of Control	Hair Treatment
Ohio	10	1 - 11	10	7	Saturated
Oklahoma	10	1 - 14	1	2–3	Mist
Florida	3 farm herds	1 - 15	1	2–3	With brush
New Jersey	55	1 - 9	1	7	Fan spray
New Jersey	17	1 - 9	2	5	Fan spray
Illinois	3 herds	1 - 9	1	4	"Pump-up" sprayer
Kansas	44	1 - 19	1	13	Sticker used
Texas	5	1 - 9	1	1–3	Coarse spray

For the past three seasons the results originally reported at Miami have been confirmed in critically conducted tests on cattle in Ohio, New Jersey, and Oklahoma. Further confirmation has been obtained also in practical usages on herds of cattle in Florida, Illinois, and Oklahoma. All of these tests were carefully made by trained observers, some of whom were excellent animal husbandmen. Also, both kinds of reports are in agreement with other reports received from cattlemen who purchased and used the sprays on their own animals.

In order that the reader may compare results of tests made with different dilutions of two sprays, they are summarized in Tables 1 and 2.

TABLE 2.—CATTLE PROTECTED FROM HORSE FLIES WITH PYRENONE CONTAINING 20 PER CENT PIPERONYL BUTOXIDE AND 1 PER CENT PYRETHRINS.

Tests Made In:	Number of Animals	Diluted with Water	Pints per Animal	Days of Control	Application
Ohio	10	1 - 19	10	3–4	Wettable powder
Texas	2	1 - 19	1	4	Emulsion

In 1947 Dr. Horace Telford (1948) of Ashland, Ohio, worked with individual cows that were known to be very susceptible to horse fly attacks. The animals were divided into two groups, one of which was allowed to graze normally in a pasture. The other group was staked with ropes and was allowed to graze in the pasture with the ones that were not tethered. By making careful observations every half-hour, it was learned that applications of two ounces of oil solutions, containing 25 mg. pyrethrins and 200 mg. piperonyl butoxide in 100 ml. of oil, protected the cows from horse flies for about two to four hours. For longer protection it was found that a concentrated emulsion containing 10 per cent piperonyl butoxide and 1 per cent pyrethrins was very effectively used when diluted with eleven equal volumes of water. The latter application, applied in sufficient quantities to insure a thorough wetting of the hair of the cows, and to a point where the spray ran off the animals, protected the cows from horse flies for seven days (Table 1). Using the same degree of coverage of the animals, it was found that a wettable powder containing 20 per cent piperonyl butoxide and 1 per cent pyrethrins diluted with nineteen volumes of water protected the cows from three to four days. In experiments with both lots of animals the applications of the spray were much greater than would need to be used in practice by a dairyman.

In Oklahoma Dr. D. E. Howell (1949) also kept his experimental animals under complete control, and the lot of ten cows was examined at half-hour intervals. A concentrated emulsion containing 10 per cent butoxide and 1 per cent pyrethrins was used at a dilution of one volume of the concentrate with fourteen equal volumes of water. It was applied as a mist on the surface of the hair at the rate of one pint per cow. Those treatments gave protection against horse flies (eleven species present) for periods varying from two to three days.

Using a slightly greater dilution and the same rate of ap-

plication of that reported in Oklahoma, Mr. W. J. Platt, Jr., (1949) obtained equal protection with Pyrenone emulsions in Florida. In his tests the emulsion was applied with a brush to the surface of the hair. On three different herds of cattle the animals were protected from horse flies for two to three days, with partial protection for about one week.

By using a fan-type spray, a more concentrated material applied at the rate of one to two pints per animal by Cowling and Donohue (1948) gave longer periods of protection from greenheads and other horse flies in New Jersey. Using a dilution that contained 1 per cent piperonyl butoxide and 0.1 per cent pyrethrins at the rate of one pint per animal, seventeen cows were treated in a herd of one hundred and five animals. The sprayed animals were protected for a period of five days. At the same time in a different herd, an application of one pint per animal was made to fifty-five cows in a herd of ninety-one animals. This treatment gave protection against greenheads and other horse flies for a period of seven days.

In Illinois Bruce (1949) used the same concentration of active ingredients as that employed by Cowling and Donohue, but he applied the treatments twice each week. This treatment schedule gave almost complete control of horse flies. Three dairy herds were sprayed twice each week with an average of one pint per animal. The spray used was Emulsifiable Pyrenone 10-1 diluted with nine equal volumes of water. The owners of these animals carefully observed a complete protection of the sprayed cows, while the unsprayed animals averaged about fifty horse flies per cow. These experiments were so striking that neighboring dairies soon followed the same spray program as that used in the experiments, with equal protection of the cows.

For the past two seasons Emulsifiable Pyrenone 10-1 has been available commercially and has been used at dilutions of one plus nine volumes of water in dairies of different Corn Belt States. The experiences of the different dairies has shown a distinct preference for this dilution and for an average rate of application of one pint of spray per animal. In a few instances twice this dilution and two pints per cow was preferred because it seemed to wet all of the hair of the animals.

Some practical tests made in the late summer of 1949 suggest that a sticker might be used with a Pyrenone emulsion to prolong its efficiency against flies. Mr. Ray Cuff (1949) of the Livestock Loss Prevention Board, working in Kansas, used

0.12 per cent of fused bentonite (Kolofog) sticker to a concentration of 0.5 per cent piperonyl butoxide and .05 per cent pyrethrins, and applied it at the rate of two quarts of the spray per animal on forty-four cows. It gave practical protection for a period of thirteen days, while untreated animals were greatly annoyed.

In South Carolina a resin was used in diluted Pyrenone sprays on cattle that grazed along the creeks. These animals were protected for eight days from the first treatment, and fair protection was reported for fifteen days following the second or third treatments. Because these longer periods were obtained in areas where there was a high relative humidity, it appears that this may be an important factor in extending the period of protection of animals by Pyrenones. Further observations might result in different schedules for spraying, depending upon the per cent of relative humidity.

Horses are protected from horse flies too. Because these animals sweat profusely at work, there is a natural dilution of the spray that reduces the period of effectiveness of Pyrenone emulsions. At Menard, Texas, Mr. H. E. Parish (1948) found that horses used for herding cattle were protected for a period of one day from a single spraying. A spray containing 1 per cent piperonyl butoxide or one containing 0.2 per cent of this ingredient, with one-tenth as much pyrethrins in each case, gave about equal protection of horses from horse flies. Single applications of emulsion sprays made in different parts of the United States by expert horsemen have given protection of four to five hours to as long as one day, the period of effectiveness depending upon the amount of sweating of the individual horse. These men agree that Emulsifiable Pyrenone is the only spray that has really protected a horse from horse flies. They have observed also that it protects horses from stable flies, deer flies, and biting gnats.

SUMMARY

1. Horse flies constitute a serious problem for owners of livestock, through loss of blood and annoyance to animals and because of their abilities to transmit blood-borne diseases.

2. The breeding places of horse flies are so extensive and so inaccessible for control that there is no practicable means for controlling the breeding areas of these pests.

3. Predacious dragon flies assist in reducing the numbers of horse flies, but they are not sufficient to afford satisfactory

control of these pests. A hymenopterous egg parasite, *Phanurus emersoni* Gir., is effective in preventing hatching of the eggs of horse flies, but on account of its short range of flight it requires timely and careful introductions to the exact breeding areas of horse flies.

4. In eight different states and in as many different locations where horse flies are serious pests of livestock, cattle were protected from one to eight days by applications of emulsion sprays containing piperonyl butoxide and pyrethrins, the degree of protection depending upon the dilution and rates of application used on the animals.

5. Emulsion sprays effectively protected riding or work horses from horse flies for one day or less. The shorter periods of protection of horses result from excessive perspiration of the animals.

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A NEW MICROVELIA FROM FLORIDA (HEMIPTERA, VELIIDAE)

ROLAND F. HUSSEY, Florida Southern College
and
JON L. HERRING, University of Florida

Microvelia alachuana, n. sp.

This new species is very similar to *Microvelia gerhardi* Hussey 1924, which was described from Colorado and western Nebraska. Like that species, it has males which are smaller, yet with longer legs and antennae (both relatively and absolutely), than the females. It averages slightly smaller than *M. gerhardi* and is distinctly narrower, especially in the males. The coloration is generally paler; the incisures of the connexivum below are not marked with fuscous; the second and third antennal segments are dark at base and apex and broadly banded with testaceous at the middle, or (in paler specimens, especially males) are ivory white below with the ends of the segments dark, while the upper surface is as just described. Rarely the pale bands are obsolete and indistinct. The first genital segment of the male is without a transverse welt below, and without backwardly directed setulae. The last dorsal tergite of the female has a sub-marginal row of long sub-horizontal hairs, often forming a distinct tuft at the middle, projecting well beyond the apex of the genital segments. No such arrangement of hairs is found in females of *M. gerhardi,* which also has the semi-erect hairs on the lateral parts of this sclerite shorter and scantier than in *M. alachuana.*

DESCRIPTION: Color dark gray above, the pronotum with a narrow transverse ferrugineous fascia more or less interrupted at the middle; dorsum with fine prostrate golden pubescence over much of its surface, ornamented with short silvery pile toward the sides of the pronotum, on two or sometimes four (2.2) small areas on the anterior lobe of the mesonotum [1] and on two obsolete para-median vittae of its posterior lobe, at the sides of the first, fifth, sixth and seventh abdominal segments, on the entire second and third segments and a small triangular median spot on the fourth, also on the third, fifth and sixth connexival segments above. Mesonotum sometimes more or less testaceous on the middle portion. Connexivum flavo-testaceous above with the extreme lateral margin very narrowly, the incisures much more broadly fuscous, flavous beneath without fuscous markings. First antennal segment pale testaceous, its basal third yellowish,

[1] Hussey erroneously referred to this as the posterior lobe of the pronotum in his description of *M. gerhardi* (Bull. Brooklyn Ent. Soc. 19: 164; 1924).

the apex most commonly infuscated; second and third segments fuscous, more or less broadly banded with testaceous at the middle (sometimes obsoletely so), the pale band of the third segment wider than that of the second and occupying more than half the length of the segment; first three segments in pale specimens (especially males) often ivory white on the under side with the apices of the segments, also the bases of the second and third, dark fuscous; fourth segment always dark fuscous, almost black. First three segments with fine prostrate pilosity, the fourth one very finely setulose; third segment thinnest, the second very slightly thicker at its apex than at the base but nowhere thicker than the first segment. Apex of the tylus nearly (14/30) reaching the middle of the first antennal segment in the female, not nearly so (13/35) in the male.

Beneath plumbeous, the pleura with fairly long silvery pubescence, the venter with a narrow band of short golden pubescence along each lateral margin and extending onto the connexivum; spiracles and intersegmental glandular openings black, the spiracles (except the last pair) transverse, narrowly oval or cuneiform. Tylus, antenniferous tubercles, last rostral segment and a median vitta on the preceding segment, blackish-piceous. Acetabula, coxae and legs varying from ivory white or luteous to dark testaceous, quite variable in the extent of their infuscation, the femora often longitudinally vittate with fuscous on the postero-ventral face, or sometimes similarly vittate on the upper side, the extreme apex most commonly blackish; tibiae blackish at base and apex, those of the front and middle legs otherwise scarcely darker than their femora, those of the hind legs more definitely embrowned. Fore tarsi yellow on the basal half, fuscous on the apical half; middle and hind tarsi with the first segment yellow, the second fuscous. Trochanters with a small piceous spot at the apex below.

Coxae, trochanters and femora rather closely pubescent below and also with fairly abundant longer pilosity. Fore tibiae quite thickly pilose, especially toward the apex, the inner face in both sexes shallowly longitudinally excavate toward the apex. Middle tibiae with six to ten long hairs below on the apical half, the proximal ones distinctly longer than the thickness of the tibia. Hind tibiae with numerous close-set oblique spinulae above on the apical half or more, and with a sub-apical comb of close-set similar spinulae.

Venter flattened on the disk, with a distinct impressed median line. First genital segment of the male deeply depressed below the level of the apex of the last ventral segment, without a transverse ridge and without backwardly directed setulae, the depressed area blackish, the remainder of the segment flavous beneath, moderately pilose at the sides. Last dorsal tergite of the female with a fringe of long sub-horizontal hairs arising from the apical submargin, often forming a distinct tuft at the middle, projecting very distinctly beyond the apex of the genital segments.

Male: Length 2.50 to 2.90 mm. Fore femora with a single short spur below at about one-third the length of the femur before its apex; fore tibiae with a black, oval, plate-like comb on the ventral surface, about one-fourth as long as the tibia, projecting spur-like for a very short distance beyond the tip of the tibia. Hind femora with two to five distinct teeth below on the apical third, some of these sometimes reduced to minute tubercles.

Female: Length 2.80 to 3.25 mm., more broadly fusiform than the male, with shorter legs and antennae. Fore femora without a spur, fore tibiae without a comb, hind femora unarmed below.

Alate male: Length 2.95 mm., humeral width 1.13 mm. Blackish, the pronotum and veins of the corium with minute golden pubescence, the antero-lateral part of the pronotum and an oblique fascia each side within the postero-lateral margin provided with longer silvery pubescence. Pronotum with a rusty-brown fascia behind the anterior margin; postero-lateral margins with a yellow border beginning at either side of the posterior angle and continuing narrowly under the humeral angles to join the broadly flavous hind margin of the prostethium. Pronotum anteriorly with an obsolete median longitudinal carina whose length is more than half the length of the pronotum. Hemelytra barely surpassing the genital segments, the membrane with distinct veins; apical part of the two discoidal cells and of the claval areole sordid whitish, as also a broad area anteriorly in the anal cell within its transversely wrinkled anal margin.

The following table gives comparative measurements, expressed in millimeters, for the apterous form of each sex of *Microvelia alachuana* and *M. gerhardi.* The measurements of *alachuana* are averages of five specimens of each sex, while those of *gerhardi* were taken from the male holotype and female allotype respectively. The femora were measured on the posterior margin.

	M. alachuana		*M. gerhardi*	
	♂	♀	♂	♀
Total length of body	2.74	3.05	3.00	3.23
Maximum width (apterous)	0.97	1.22	1.10	1.31
Total length of antenna	1.81	1.54	1.77	1.54
Length of head plus thorax	1.17	1.25	1.26	1.31
Width of head including eyes	0.68	0.74	0.76	0.78
Anterior interocular width	1.32	0.38	0.38	0.41
Antennal segment I	0.44	0.38	0.45	0.40
II	0.39	0.30	0.38	0.31
III	0.44	0.36	0.44	0.38
IV	0.54	0.51	0.50	0.45
Fore leg: Femur	0.73	0.70	0.78	0.76
Tibia	0.73	0.61	0.75	0.69
Tarsus	0.34	0.35	0.36	0.36
Middle leg: Femur	0.95	0.88	0.98	0.96
Tibia	0.97	0.86	0.99	1.00
Tarsal I	0.30	0.27	0.26	0.25
Tarsal II	0.30	0.30	0.31	0.31
Hind leg: Femur	1.11	1.03	1.13	1.09
Tibia	1.40	1.32	1.40	1.44
Tarsal I	0.31	0.31	0.31	0.31
Tarsal II	0.31	0.31	0.34	0.35

Described from sixty-two specimens taken from Little Hatchet Creek, near Gainesville, Alachua County, Florida, March 5, 1950 (Jon L. Herring). Apterous holotype and allotype, alate morphoholotype, and paratypes in the collection of the Museum of Zoology of the University of Michigan; additional paratypes in the collections of the United States National Museum, the Snow Entomological Museum of the University of Kansas, the University of California, Dr. Carl J. Drake, Dr. H. M. Harris, Mr. J. E. Burgess, Jr., and the authors. We have also seen a smaller series of specimens taken by the junior author at the same locality on March 26, 1948.

ECOLOGICAL NOTES

Microvelia alachuana is known from a single sand bottomed stream at Alachua Airbase near Gainesville. This stream, known as Little Hatchet Creek, runs through a canyon whose walls are thirty or more feet high. Although deepened by artificial means, the canyon is being cut down by the stream itself during the rainy season of the year. The walls are steep and are composed of yellowish sands mixed with beds of white to green clays. Many fossils of Miocene age are present in the stream bed.

The stream is quite narrow in the portions of its course where *M. alachuana* was found. In this area the banks of the stream are only two or three feet wide. Practically no vegetation exists in the stream but many vines and herbaceous plants have moved in from the area above and formed dense tangles of vegetation along the banks. In many places, rocks have formed dams to the stream so that small, still pools occur along the bank. These pools are only a foot in diameter and one or two inches deep.

M. alachuana was observed by the junior author in great numbers scurrying about over the wet clay banks and in the small, clear pools along the shore. This form is well concealed in its habitat as its coloring blends well with the gray of the clay banks. Several hundred specimens of *Rhagovelia choreutes* Hussey were collected with *alachuana* on March 26, 1948.

MINUTES OF THE THIRTY-SECOND ANNUAL MEETING OF THE FLORIDA ENTOMOLOGICAL SOCIETY

(Continued from Last Issue)

Dr. Wilson then moved, and insisted, that Mr. Van Horn not be permitted to escape his obligation of giving a presidential address, and that he be required to present a talk along with Mr. Mulrennan at the 1950 annual meeting of the society. The motion was seconded and passed by the society.

Dr. Wallace moved that a committee be appointed to study the constitution with the idea of amending it to permit the executive committee to elect entomologists to membership in the society, so that it would be unnecessary to have a full meeting of the entire organization in order to bring in new members. The motion was seconded by Dr. Wilson and passed by the society.

Mr. Mulrennan then read two letters inviting the society to meet in Miami and in St. Petersburg in 1950. It was decided to refer the matter to the executive committee for study and recommendation.

The business meeting was adjourned at 2:05 P. M. Twenty-two members signed the attendance register.

Mr. Mulrennan called a special meeting on the morning of December 17 at 9:00 A.M. to pass on some additional persons seeking membership in the society. The meeting was called to order at 9:00 A. M. in the Hillsborough Hotel. The president asked that the names of the nominees be presented for consideration. The following were submitted for associate membership—F. G. Butcher, J. O. Pepper, and W. C. Rhoades. Mr. Van Horn moved that the recommendations be accepted. Mr. Bruce seconded the motion and it was passed by the members.

Mr. Mulrennan called for other business. Dr. Wilson moved that the society adjourn as a group and then reconvene as a resolutions committee. The society adjourned at 9:05 A. M.

Dr. Wilson then moved that the secretary be empowered to prepare a resolution of commendation for those who have actively contributed to the success of the meetings in Tampa and that the resolution be published in the FLORIDA ENTOMOLOGIST. Also, a paragraph should be included to thank the Tampa officials for their invaluable assistance. This resolution was passed by the committee.

The meeting then reconvened at 9:10 A. M. Mr. Van Horn

submitted the following recommendations as a means of increasing the efficiency of the organization:

1. That a post office box be secured in Gainesville.
2. That letterhead, envelopes, statements, etc., be standardized for the use of all officers of the society.
3. That applications for membership be reprinted with the permanent post office box as the mailing address of the society.
4. That there be a more vigorous advertising campaign and that the membership campaign be reinvigorated.
5. That the society consider electing a permanent secretary and business manager and that some token payment be made to them. The two officers should be located in Gainesville.
6. That the secretary be empowered to employ student help.
7. That an advertising committee be appointed.

The special business meeting was adjourned at 9:15 A. M.

LEWIS BERNER,
Secretary

REPORT OF THE TREASURER BUSINESS MANAGER

For the Year Ending December 1, 1949

RECEIPTS:		
Balance on hand December 13, 1948	$ 226.78	
From Sub. to The Fla. Ent.	86.75	
Membership dues (current and back)	292.00	
Sale of back issues The Fla. Ent.	72.41	
From members for reprints, plates, etc.	189.12	
From advertisements in The Fla. Ent.	583.25	
From contributions	1.00	
Total	$1,451.31	$1,451.31
EXPENDITURES:		
Cost of printing The Fla. Ent.	$1,129.16	
Postage, stationery and other supplies	103.17	
Exchange on checks and money orders	6.19	
Miscellaneous	6.31	
Total	$1,244.83	$1,244.83
		$ 206.48
Balance an hand December 1, 1949—Cash	$ 4.75	
Florida State Bank, Gainesville	201.73	
		$206.48

ASSETS NOT SHOWN:

Monies received misc. since Dec. 1, 1949	$ 47.00
Due from advertisements Fla. Ent. Vol. 32, No. 4	172.50
Due from members for plates and reprints, Vol. 32, No. 4	26.10
Total	$245.60
Pepper Printing Co., Nov. 30, Balance	$21.93
Pepper Printing Co., The Fla. Ent. Vol. 32, No. 4	Bill Not Received

Respectfully submitted,

GEORGE W. DEKLE

Treasurer and Business Manager

REPORT OF THE AUDITING COMMITTEE

We have examined the financial report as shown on the reverse side of this sheet and find it correct.

We wish to extend the highest appreciation for the very fine work done by the business manager.

WILLIAM P. HUNTER GEORGE B. MERRILL

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For Agricultural Dusts —

CP-5 DUST STICKER

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Because of its ability to control many diseases of many crops *without retarding plant growth*, DITHANE is helping thousands of farmers to increase yields of potatoes and other crops.

The unique insecticidal qualities of RHOTHANE help orchardists through effective control of such pests as the red-banded leaf roller on apples, the orange tortrix on pears, apples, grapes and other fruit.

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PROTECT your crops with **FASCO** and **IDEAL** Brand insecticides and fungicides—ideally suited for control of insect pests, fungus attacks and plant diseases in grove, orchard, garden or field.

CONSULT with the trained field representatives of Wilson & Toomer and Florida Agricultural Supply companies who are always available for sound, experienced advice.

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Here is a partial list of pesticides obtainable direct from your **FASCO** dealer, **IDEAL** Brand Warehouse or through our field representatives:

COPPER SPRAYS and DUSTS—
- Fasco "Nu-Tri-Cop" Spray
- Fasco Neutral Copper Dust
- Fasco Cuminoil Emulsion (Copper Oil)

ORGANIC INSECTICIDES—
- Sprays, Dusts, and Bases
- Terpene (Toxaphene) Products
- BHC Products
- Chlordane Products
- TEPP Sprays
- DDT Products
- Parathion Products

SULPHURS—
- Dusting Sulphurs
- Wettable Sulphurs

AGRICULTURAL BAITS—

LIME SULPHUR SOLUTION—

IDEAL BRAND OIL EMULSION CONCENTRATE—

"IFN" (Nutritional) SPRAYS and DUSTS—

"DE-KA-GO" TREE WOUND PAINT—

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A safer fungicide for copper-sensitive plants.

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DEENATE* DDT
Insecticide in five formulations.

FERMATE*
Organic fungicide, ferric dimethyl dithiocarbamate, adapted for use as preventive for diseases on fruits, tobacco, ornamentals and certain vegetables.

KRENITE*
Water-soluble dinitro spray, both insecticide and fungicide.

LEXONE* 10-GW
BHC wettable powder, but usable as dust.

MARLATE* 50 INSECTICIDE
Methoxychlor insecticide for fruits, vegetables and livestock—particularly dairy.

PARZATE* FUNGICIDE
Organic fungicide based on zinc ethylenebisdithiocarbamate for control of principal diseases on potatoes and certain other vegetable crops.

PARZATE* LIQUID
A fungicide based on disodium ethylenebisdithiocarbamate.

SULFORON* X
Micro-fine wettable sulfur fungicide.

ZERLATE*
Organic fungicide based on zinc dimethldithiocarbamate, compatible with most insecticides.

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AMMATE*
Ammonium sulfamate, non-selective weed killer for control of hard-to-kill woody weeds and brush.

Du Pont 83% Sodium 2,4-D Weed Killer
Sodium salt of 2,4-D acid for control of many broad-leaf plants, selectively.

Du Pont 2,4-D 65% Amine Weed Killer
Contains 2,4-D as triethanolamine salt, formulated for low gallonage applications.

Du Pont 2,4-D 74% Amine Weed Killer
Contains 2,4-D as triesopropanolamine salt, formulated for low gallonage applications.

Du Pont 2,4-D 46% Ester Weed Killer
An oily, liquid form of 2,4-D containing 46% isoproyl ester.

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NON-DRIFTING—STICKING— A dense cloud that hugs the crop and adheres electrostatically (even to the under side of foliage when dry) insures less waste and permits effective daytime dusting.

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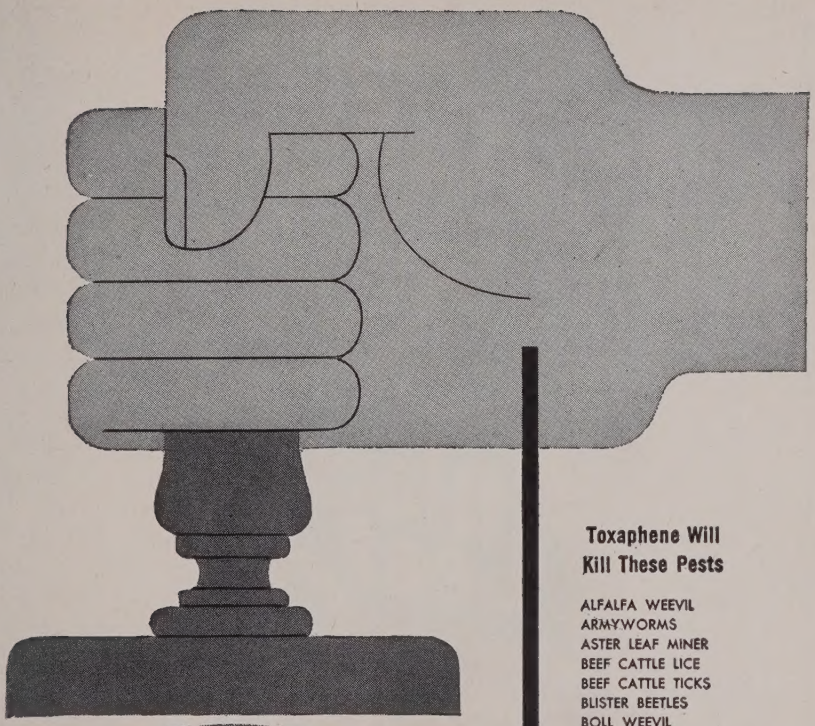

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